Overview of U.S. Electronics Stewardship Initiatives

Prepared for the National Electronics Stewardship Workshop

National Conservation Training Center
Shepherdstown, West Virginia

February 26-28, 2001

Table of Contents

1 Introduction

As a major consumer the Federal government can have a tremendous influence on the design of electronic products through its procurement practices and the development of the emerging electronics recycling infrastructure through its own disposition practices. The U.S. government can further influence product design and infrastructure development through its research and policy initiatives.

This background paper is intended to serve as a reference document on which the dialogue at the National Electronics Stewardship Workshop can build. The paper provides an overview of current Federal procurement programs and initiatives to manage its end-of-life (EOL) electronic equipment. It then turns from internal management issues to Federal policies and programs designed to influence Federal practices as well as other constituencies, including industry, state and local governments and consumers.

Policies and programs to promote the environmentally sound design and disposition of electronics are gaining momentum across the United States. To round out the picture of "the state of play" for electronics recycling and life cycle management, this paper also briefly summarizes some initiatives of not-for-profit organizations, state government and industry organizations, as well as providing a brief synopsis of international developments. There are far too many efforts underway across the U.S., particularly at the state and local levels and within industry, to summarize in this document. Several of the Internet sites referenced in this paper provide useful links to additional resources and programs.

2 Current Management Practices for Federal EOL Electronics

The inventory of electronic assets in the Federal government covers a broad range of equipment from personal computers to communications equipment and military hardware. In some Agencies, like the Department of Education, personal computers (PCs) make up the majority of EOL electronic assets. In other Agencies, such as the Department of Defense (DoD), PCs represent a small percentage (about 20 percent) of the total electronic assets. The EOL electronic equipment in Agencies such as DoD and the National Aeronautics and Space Administration (NASA) consists largely of laboratory and test equipment, communications equipment and "special tools" (e.g., components of the space shuttle, air and ground warfare equipment).[1]

2.1 Managing EOL Electronics Through Procurement Vehicles

A growing trend among Federal agencies is the outsourcing of information technology equipment and services in order to control life cycle costs and manage technology obsolescence. Outsourcing of computer equipment and related services is being accomplished through a number of Federal contracts, such as Seat Management

[1] Final Report of the Federal Electronic Asset Management Task Force, February 16, 1999, p. 3.

Contracts, which place the responsibility for furnishing, maintaining and disposing of equipment, as well as staffing the "help desk", with an outside contractor. While these outsourcing contracts do not address specifically the end-of-life management of computer equipment, they do remove the burden of EOL management, as well as the oversight of environmentally sound disposition, from the Government.

Federal agencies currently using Seat Management Contracts include General Services Administration (GSA), Housing and Urban Development (HUD), Department of the Treasury, State Department, DC Housing Authority, Army Substance Abuse Center, the Peace Corps and Wright Patterson Air force Base. NASA has its own version of Seat Management contracts called the Outsourcing Desktop Initiative for NASA (ODIN). ODIN is a long term outsourcing arrangement with the commercial sector which transfers the responsibility and risk for providing and managing the vast majority of NASA's desktop, server and intra-center communications assets and services. Currently the Health Care Finance Administration is also using ODIN.

The Department of Transportation (DOT) also developed a procurement vehicle similar to SEAT, called ITOPs. ITOPs provides a broad range of support resources related to information technology solutions including technical services, hardware and software. In addition to DOT, ITOP clients include the Executive Office of the President, Security and Exchange Commission, U.S. Agency for International Development, Social Security Administration and the U.S. Departments of Justice, Energy, Commerce, Agriculture and Education.

2.2 Federal Agency Disposition Programs

Similar to the private sector, Federal disposition programs combine reuse to capture the remaining value in electronic equipment with demanufacturing to remove hazardous materials, recover components and recycle materials.

2.2.1 Federal Property Management System

Used and end-of-life electronic products are governed by the requirements of the Federal Property and Administrative Services Act of 1949, as amended. Agencies must first use items in their custody to the maximum extent possible. When no longer needed to fulfill an Agency's mission, civilian property is reported to GSA and processed as follows:

1) **Utilization**. An Agency declares the property "excess" and refers it to the General Services Administration for government-wide screening. GSA makes "excess" equipment available for transfer to other Federal agencies for their direct use or for use by their contractors, cooperatives, or project grantees.

2) **Donation.** GSA offers eligible non-Federal organizations the opportunity to obtain "surplus" Federal personal property through State Agencies for Surplus Property (SASPs.) Surplus is defined as equipment that no longer meets the

needs of any Federal agency. Surplus property can be acquired by a wide variety of non-Federal public agencies and private non-profit organizations and institutions, such as educational activities and programs for the elderly and homeless.

3) **Sale**. GSA also gives individuals and businesses an opportunity to buy items the Federal Government no longer needs. GSA sells personal property from civilian Federal agencies via sealed bid, fixed price, auction, spot bid and negotiated sales.

4) **Abandonment/destruction**. Items with no commercial value or sensitive items may be disposed of at least cost to the government and in a safe and secure manner.

One exception to this process is the Computers for Learning program (described below), which allows Federal agencies to directly donate their excess computer equipment for eligible educational purposes.

2.2.2 Federal Executive Order on Educational Technology

Both civilian and military agencies are subject to Executive Order 12999, *Education Technology: Ensuring Opportunity for All Children in the Next Century.* The Executive Order (EO) streamlines the transfer of excess and surplus Federal computer equipment to the Nation's classrooms for the purpose of improving children's access and use of information technology in the classroom. The EO specifically states that Federal equipment is a vital national resource, and:

> *To the extent such equipment can be used as is, separated into parts for other computers, or upgraded -- either by professional technicians, students or other recycling efforts--educationally useful Federal equipment is a valuable tool for computer education. Therefore, to the extent possible, all executive departments and agencies shall protect and safeguard such equipment, particularly when declared excess or surplus, so that it may be recycled and transferred, if appropriate, pursuant to this order.*

GSA has responsibility for promoting the EO and helping other federal agencies and potential recipients transfer equipment. Under the Federal EO, government agencies are supposed to report excess equipment for donation to the General Services Administration. In 1997, approximately 70,000 pieces of equipment were transferred to schools from federal agencies.

A recent change in military policy will alter the flow of computers to schools. A letter from the Deputy Secretary of Defense, dated January 8, 2001, orders the removal and destruction of all computer hard drives-even those handling unclassified data - prior to disposal. This policy, in effect, eliminates the reuse of DoD computers. This action comes as a result of a security review that found sensitive military data remaining on hard drives that were erased. Before the policy change, the Pentagon had required the

destruction only of those hard drives that processed classified data, once the computers were deemed obsolete.

2.2.3 Department of Defense

The Defense Reutilization and Marketing Service (DRMS) manages "excess and surplus" DoD property including electronics (see www.drms.dla.mil/). The disposal process is in compliance with the Federal Property and Administrative Services Act of 1949, as amended, with guidance from the Defense Material Disposition Manual. Figure 1 illustrates the management of excess and surplus equipment in DoD. Excess means "useable property excess to the needs of the current DoD owner." Surplus is "surplus to the needs of the Federal Government." DRMS processes equipment through the Reutilization, Transfer, Donation, and Sales (RTD/S) cycle. Property becomes surplus once DoD (Reutilization) and other Federal agency (Donation) customers have finished screening. The property is then offered to "authorized Donees" and finally sold to the general public. Property that fails sale are downgraded and sold as scrap. There are also many items that are received and managed as scrap.

The Defense Reutilization and Marketing Service awarded an electronic equipment demanufacturing contract in December of 1998. The contract is designed to assure compliant disposal of all hazardous components contained within electronic equipment, to meet the Department of Defense's requirements for proper demilitarization and to maximize the return to the DoD on the resultant precious and valuable metals and other recyclable materials.

The contractors selected by DRMS use state-of-the-art processes to identify and sell any usable items and components. They dismantle electronics not suitable for sale, identify, remove and properly dispose of any hazardous components, and then, sort, segregate and upgrade the remaining scrap to maximize return to the U.S. Government. The process involves recycling of all material, with a minimal amount of material sent to landfills. Tracking, auditing and security are extremely important components of the electronic equipment salvage and recovery operation. Tracking by weight, scrap classification, and demilitarization (DEMIL) code are mandatory throughout the entire process.

This program is an example of military/private sector cooperation and is patterned after similar private sector contracts, associated with major electronic manufactures, who share the same concerns for the environment and security. The private sector expertise in identification of hazardous materials will avoid the costs of future environmental cleanup at traditional "smash and grab" scrap yards. Shredding of components assures proper demilitarization and the destruction of "technology" which is regulated by law against export.

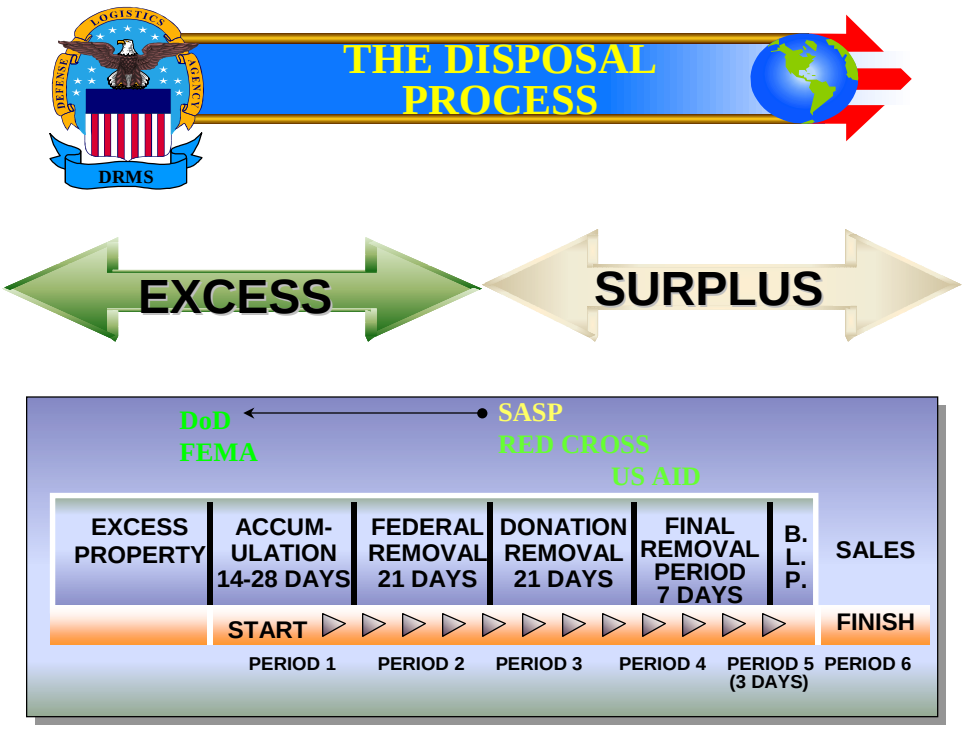

Figure 1: DRMS Disposal Process

At the onset of this initiative DRMS believed that the demanufacturing contracts could be executed at no cost to the Agency. However, for the net return to be positive, cost avoidance factors must be considered in the equation. The Agency believes the costs are justified based on the value-added in terms of minimizing environmental, health, safety and national security risks. With improvements in logistics, administration and asset mix, there is a potential for no cost processing. This includes a promising partnership with the Federal Prison Industries (UNICOR). DRMS is currently in negotiation with UNICOR to process DoD surplus computers and automatic data processing equipment. An agreement is contingent upon UNICOR meeting the same technical standards outlined in DRMS' demanufacturing contracts. UNICOR has the potential to offer a low or no cost solution for processing computers and is supported by the Federal Acquisition Regulations (FAR), which authorizes non-competitive procurement.

2.2.4 Department of the Interior

In the Washington, D.C. Metropolitan Area, the Department of the Interior offers computer recycling through its National Business Center (NBC). NBC has an agreement with DOD's Defense Reutilization and Marketing Service, which allows Interior to use a DRMS contractor through an existing contract.

2.2.5 United States Postal Service

The United States Postal Service (USPS) is partnering with Per Scholas, a not-for-profit computer demanufacturer and recycler. Per Scholas was founded by a consortium of foundations and corporations, with a mission to bridge the "digital divide" by creating computer access to under-served, low-income schools and families, in its electronic equipment demanufacturing and training efforts. USPS is donating 15,350 personal computer systems for recycling, as well as providing USPS vehicles to transport computers for reconditioning.

2.2.6 Department of Energy

The Department of Energy (DOE) has established a unique and innovative partnership for electronics recycling with the DOE Oak Ridge Operations Office of Assets Utilization, the Community Reuse Organization of East Tennessee (CROET) and The Oak Ridge National Recycle Center (TORNRC). Via CROET, DOE funded grants to research better methods for recycling glass and plastics and established an electronics recycling pilot project. The pilot project, operated by a commercial company, was established at the East Tennessee Technology Park (ETTP) site in Oak Ridge, Tennessee. This partnership allows DOE to recycle its electronics and avoid costly disposal. It also allows TORNRC to refurbish the electronics for reuse or recycle of the basic components (e.g., plastic, metal, and glass) for profit. Using this strategy, TORNRC is achieving a 99% recovery rate on all materials received. As a result of this unique teaming arrangement, over 1,190 metric tons of surplus electronic type materials have been recycled, resulting in a cost avoidance to DOE of $1.3 million dollars to date.

Through joint efforts by the three organizations, electronics are not only being recycled from the Oak Ridge Reservation but from other DOE sites as well. The recycling initiatives have also been expanded from the recycle and reuse of standard computer type equipment to cold war era scientific equipment. The recycling of this type of equipment is being done through innovative bartering agreements where TORNRC removes the surplus equipment from facilities for recycle/reuse in exchange for the value of the equipment. Not only does TORNRC save DOE money from avoided disposal, but they also save DOE money due to schedule reductions at the closure sites. Any government agencies can utilize the existing agreements put in place by DOE. DOE is also willing to work with other government agencies to further develop and implement these strategies to make them agency specific where needed.

2.3 Multi-Agency Initiatives

2.3.1 Federal Electronic Asset Management Task Force

In 1998, the Federal Electronic Asset Management Task Force was created by the Office of the Federal Environmental Executive. The purpose of the Task Force was to assess the status of electronic asset management within the Federal government and to

develop recommendations addressing design, acquisition, disposition and communication issues.

The Task Force draft recommendations, which were never finalized, called for a comprehensive electronic asset management system that combines the existing system for disposing of Federal personal property (the Federal Property Management System) with "newly engineered" electronic demanufacturing systems. Combining these two systems would ensure that an attempt is first made to reuse electronic assets, if possible, and, if not, are disposed of in a matter that minimizes wastes going to landfills. The Task Force further recommended that the General Services Administration, the manager of the Federal property management system, work with all Federal agencies to improve the current property management system. Other recommendations addressed steps that Federal agencies should take to ensure that electronic assets donated or sold to parties outside the Federal government are disposed of in an environmentally sound way.

2.3.2 Memorandum of Understanding Among Government Agencies

In 2000, five Federal agencies -- including the U.S. Postal Service, the Department of Defense, the Department of Energy, the Department of the Interior and the Environmental Protection Agency – drafted a Memorandum of Understanding (MOU) that seeks to reduce environmental impacts of electronic equipment through improvements in acquisition, design, manufacturing, distribution and use of new equipment, and the reuse, demanufacturing and recycling of surplus equipment. The Parties to the MOU commit to working together on six specific objectives:

1) Increase demand for "greener" electronic equipment while maintaining or improving equipment quality and performance;
2) Promote the implementation of best life cycle management practices for electronic equipment and share these best practices with parties outside the Federal government;
3) Reduce the economic and environmental life cycle costs of Government electronic assets;
4) Encourage growth of the infrastructure for the reuse, demanufacturing and recycling of obsolete equipment;
5) Strive for "zero waste" in the disposition of electronic equipment and associated packaging material; and,
6) Coordinate and cooperate on other public and private efforts aimed at achieving similar objectives.

2.4 Research & Development Initiatives

2.4.1 DEER2

The Department of Defense initiated the Demanufacturing of Electronic Equipment for Reuse and Recycling (DEER2) in 1999. DEER2 is a task of the National Defense Center for Environmental Excellence (NDCEE) contract for the development,

application and dissemination of advanced technologies, awarded to Concurrent Technologies Corporation.

The mission of DEER2 is to advance the state-of-the-art of electronics demanufacturing by establishing a full-scale facility for the demonstration and validation of newly developed and commercially available technologies and processes for electronics reuse and recycling. At the same time, DEER2 is expected to establish and demonstrate methods and standards to satisfy DoD's needs for demanufacturing electronics and the recovery of systems and components necessary to maintain DoD systems.

Experts from industry -- including electronic demanufacturers, equipment suppliers and original equipment manufacturers – government agencies and academia guide DEER2 in determining the greatest needs of the industry and reviewing project status. For more information, see www.deer2.com.

2.4.2 Mid Atlantic Recycling Center for EOL Electronics (MARCEE)

The Department of Energy is funding a West Virginia-based project – the Mid Atlantic Recycling Center for EOL Electronics – to develop high-value uses for recycled glass, plastics and metals contained in computers and other electronic equipment, and establish new business opportunities through technology transfer and licensing. The goal of the project is to fill the technology gap between the current state-of-the-art and the long-term requirements for a financially-feasible, environmentally-acceptable and commercially-successful electronics recycling industry. The project is developing a business model and corresponding path to commercialization for a prototype regional electronic processing center.

The MARCEE project is a collaboration among several organizations with complementary strengths: the Polymer Alliance Zone (PAZ) and its industry consortium, West Virginia University and its research capabilities, and D.N. American, a software development firm. The PAZ/West Virginia team has aligned itself with leading technical and environmental groups throughout the United States that are working to capture maximum value from obsolete electronics. The ultimate success of the project will depend on developing high-value and economically-attractive uses for recycled plastics – historically the most challenging aspect of electronics recycling. The MARCEE has the potential to create thousands of new jobs and investments in the West Virginia region, and will serve as a model that can be duplicated throughout the United States.

The West Virginia project recently launched a web site (www.electronicsreycling.net) in an attempt to propel the fledgling electronics recycling industry forward, raise awareness about electronics recycling and promote collaboration among industry, government and consumers. The web site houses information on the multiple facets of electronics recycling, including equipment collection and demanufacturing, industry and government programs, upcoming industry events and the recycling of metals, glass and plastics. An industry directory allows businesses to

register their organizations in a database, and users to search for electronics collection and processing locations in their state. Future plans for the web site includes on-line decision-support tools for the industry and e-commerce.

3 U.S. Policies and Programs Impacting Electronic Products

Voluntary partnerships with industry and raising awareness are the cornerstone of EPA's policies and programs that target electronic products, as illustrated below. EPA's programs target environmental concerns ranging from toxics use to product reuse and recycling and try to influence different stages in the product life cycle, from design to disposal.

3.1 Common Sense Initiative

In 1994, the U.S. Environmental Protection Agency established the Common Sense Initiative (CSI) as a formal advisory council under the Federal Advisory Council Act (FACA) to bring together government, industry, not-for-profit and labor representatives. The purpose was to examine the impact of government environmental regulations and policies on six industrial sectors, including the Computers and Electronics Sector.

The Computers and Electronics Sector identified the disposition of EOL electronics as an emerging environmental issue and one in which the CSI process could make a difference. Working for almost four years, the CSI process made several important contributions designed to facilitate, better understand and increase awareness of electronics reuse and recycling.

RCRA Regulatory Barrier. Following a recommendation by CSI, in 2000 EPA proposed a rule to streamline significantly the current Federal hazardous waste handling requirements for cathode ray tubes (CRTs). The purpose of the rule is to encourage better management and more recycling of CRTs. The costs and paperwork associated with CRT recycling under current rules act as a barrier to greater recycling. The rulemaking seeks to reduce the costs of storing, transporting and processing these products when they are bound for collection, refurbishment and recycling. The rule is intended to encourage uniform regulatory treatment nationwide for handling of CRTs. Such uniformity is important to help encourage more organizations to begin collecting these products and moving them across state lines for management by the growing number of demanufacturers and recyclers of CRTs.

Residential Electronics Collection Pilots. CSI supported several pilot projects to collect and process electronics from the residential waste stream. The goals of the residential collection pilots were:

- To characterize the type and volume of end-of-life electronic equipment in the municipal solid waste stream;

- To assess the economic viability of collecting, transporting and recycling end-of-life residential equipment; and
- To evaluate alternative collection models, including one-day drop-off collection, curbside collection and retail drop-off schemes.

The resulting reports have assisted state and local governments in developing electronics recycling policies and programs.

Electronics Product Recovery and Recycling (EPR2) Roundtable. The CSI initiated and supported the formation of the EPR2 Roundtable with the intent of creating an on-going forum for the discussion and stimulation of electronics recycling in the U.S. The EPA entered into a partnership with the Environmental Health Center, a Division of the not-for-profit National Safety Council, to launch the Roundtable in 1997. The fundamental purpose of the EPR2 Roundtable was to further stimulate the U.S. electronics recycling industry and the development of environmentally and economically-sound strategies for managing end-of-life electronic equipment. EPR2 is discussed further below.

3.2 Extended Product Responsibility

The U.S. EPA supports "extended product responsibility" (EPR), as an approach to encourage sustainable product systems. This principle was articulated in the 1996 multi-stakeholder report, entitled *Sustainable America: A New Consensus*. Extended product responsibility, also known as product stewardship, calls for a "shared responsibility" approach to pollution prevention in which key players in the chain of commerce take responsibility within their sphere of influence and capabilities for reducing the environmental impacts of products throughout the product life cycle -- from product design and manufacturing to use and disposal.

Currently, Federal statutory authority to control the environmental impacts of product systems is limited. EPA, through its Office of Solid Waste (OSW), is actively promoting voluntary initiatives and collaboration among states, local governments, industry and non-governmental organizations to address the life cycle impacts of several product groups, including electronics. For electronics, EPA's EPR program has supported a number of initiatives including the Northwest Product Stewardship Council's computer purchasing guidelines, the National Recycling Coalition's Electronics Recycling Initiative and the Northeast Recycling Council's development of a manual that analyzes collection models for communities and small businesses. All of these initiatives are described in greater detail in subsequent sections.

EPA's Extended Product Responsibility program has primarily focused on end-of-life considerations as a means of driving environmentally conscious design and resource conservation. To address the full range of life cycle issues, the EPR program has also been working together with other EPA programs, as well as various public and private sector stakeholders across the country.

EPA's EPR web site (www.epa.gov/epr/) provides many links and resources by product sectors, including electronics

3.3 Design for the Environment

Initiated by EPA's Office of Pollution Prevention and Toxics (OPPT) in 1992, the Design for the Environment (DfE) Program helps businesses incorporate environmental considerations into the design and redesign of products and processes through voluntary partnerships with industry. Two of EPA's current DfE projects focus on reducing the environmental impact of electronic products.

The **Printed Wiring Board (PWB) Project** has worked with PWB manufacturers, trade associations, academic institutions and public interest groups to examine alternative technologies that reduce or eliminate the potential health and environmental risks in the manufacture of PWBs. In its first major study, the Project evaluated the health and environmental risks, performance and cost of the electroless copper process and six promising alternative technologies. The project partners have recently completed a similar evaluation of alternative surface finishes that can replace the hot air solder leveling process. For more information see www.epa.gov/dfe/pwb/pwb.html.

In its **Computer Display Project**, the DfE Program is partnering with the display industry to evaluate the life cycle impacts, performance and cost of desktop computer technologies, specifically cathode ray tubes (CRTs) and liquid crystal displays (LCDs). The project will provide data to computer display and component manufacturers and suppliers that will help them identify areas for environmental improvement, and that will encourage them to consider environmental factors when manufacturing and purchasing computer displays or components (see www.epa.gov/dfe/compdisp/compdisp.html).

At industry's request, EPA is considering a third project in the electronics sector that examines environmentally preferable substitutes for tin-lead solder. The industry would like to choose replacement solders that have a net positive effect on the environment.

3.4 Energy Star

The ENERGY STAR label (the symbol for energy efficiency) was created by the U.S. Environmental Protection Agency and the Department of Energy to make it easy for consumers to identify and purchase products that save energy and money. Since 1992, EPA has worked with manufacturers to develop energy-efficiency guidelines for a variety of products for the home and office. The Energy Star Labeling Program now covers 29 product types including computers, monitors, televisions, VCRs and copiers. Over 1,200 Manufacturing Partners ship more than 50 million ENERGY STAR qualified products each year. Eighty-five to 95 percent of office equipment manufacturers (e.g., computers, monitors, copiers) participate in the ENERGY STAR program. For more information see www.epa.gov/energystar/.

3.5 WasteWise Electronics Challenge

EPA's WasteWise Program, now in its 7th year, is a voluntary program aimed at reducing the generation of non-hazardous solid waste. As a WasteWise partner, organizations commit to examining their operations and purchasing practices and identifying measurable goals, based on their own circumstances, in three program areas: waste prevention, recycling collection and buying or manufacturing products with recycled content. Over 1,000 corporations, government agencies, universities and other organizations participate in the WasteWise Program (see www.epa.gov/wastewise/).

To help WasteWise partners expand their existing waste reduction programs, the EPA has added Challenge programs that focus on a specific material or product types. The most recent Challenge adopted by the WasteWise program targets electronic products, including personal computers and peripherals, portable computers, facsimile machines, copiers, televisions, telephones and audio/visual equipment or CAD equipment.

A variety of activities qualify as waste reduction under the Electronics Challenge program, including: donating or recycling usable equipment, purchasing remanufactured equipment instead of new equipment and leasing rather than purchasing electronic equipment. Manufacturers can also consider options such as establishing product recovery programs for used equipment or redesigning products so that they can be more easily upgraded or remanufactured. Incentives for participating in the Electronics Challenge include access to technical assistance and possible recognition for waste reduction achievements. Starting in 2001, EPA will specifically recognize an organization as Electronics Challenge Partner of the Year.

3.6 Environmentally Preferable Purchasing

Executive Order 13101, *Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition* (September 1998) commits the Federal government to minimizing the adverse environmental impacts of its purchases. Guidance to Federal agencies on implementing environmentally preferable purchasing (EPP) is provided in U.S. EPA's *Final Guidance on Environmentally Preferable Purchasing* (August 1999). For more information see www.epa.gov/opptintr/epp.

Five guiding principles are the foundation of EPA's EPP guidance:

1) Include environmental considerations as part of the normal purchasing process along with traditional factors such as product safety, price and performance;
2) Emphasize pollution prevention early in the purchasing process;
3) Examine multiple environmental attributes throughout the product's or service's life cycle;
4) Compare relevant environmental impacts when selecting products and services; and,

5) Collect and base purchasing decisions on accurate and meaningful information about environmental performance.

The EPP guidance also provides a list of environmental attributes to help federal agencies compare the environmental preferability of products and services, as well as a list of available resources.

To further assist EPP by Government agencies and others, the EPA developed a searchable database of product-specific environmental information. The database is organized like a giant shopping mall with environmental information for selected products and services located within each store. Information on computers, for example, can be found in the Computer Store (see www.epa.gov/oppt/epp/database.htm).

The database links purchasers to several types of information developed by government programs, both domestic and international, as well as third parties, including:

- Contract language developed and used by federal and state governments and others to purchase environmentally preferable products;
- Voluntary standards and guidelines; and
- Other information on environmentally preferable attributes.

A search in the Computer Store provided links to the State of Massachusetts RFR for electronic recycling services and computer procurement, environmental criteria for the German Blue Angel ecolabel and U.S. EPA's Energy Star Program and eco-design checklists for computers.

4 Regional Policy Initiatives

4.1 Northeast Recycling Council

The Northeast Recycling Council (NERC), a regional non-profit organization representing recycling and economic development officials in the northeast, adopted a Regional Recycling Market Development Policy for Used Electronics in December 2000 (see www.nerc.org/electpolicy.html). The goal of the policy statement is to promote an economically and environmentally sustainable recycling system for used electronics in the Northeast region, and to support reductions in the volume and toxicity of electronic products. The policy reflects the growing concern of NERC members over the volume and toxicity of used electronics in the waste stream, their potential impacts on the environment if not managed properly, their demand on limited disposal capacity in the region and the cost to local governments and businesses for proper management of electronic products.

The policy statement consists of six Guiding Principles and a series of Action Steps to address each of the principles. The policy builds on EPR principles of shared responsibility and reducing the life cycle impact of electronic products. As a next step,

NERC plans to work with its multi-stakeholder advisory group to identify which Action Steps are currently being addressed and where there are gaps, and to designate WHO should be responsible for implementing the Action Steps.

NERC is also developing a "how-to" manual detailing electronics collection models and program implementation strategies for residential and small businesses. This guide will be used in two workshops that NERC will hold in 2001 to train municipal officials and small business managers on strategies for cost-effective and environmentally sound recovery and management of discarded electronics. The how-to manual will be based on an analysis of various approaches implemented across the country.

4.2 Northeast Waste Management Officials Association

The Northeast Waste Management Officials' Association (NEWMOA), a coalition of state solid and hazardous waste program directors from environmental agencies in New England and New York, has developed draft model legislation aimed at reducing mercury in waste. The model legislation proposes several mechanisms to manage mercury-containing products (including certain electronic products) and wastes. The proposed elements of the Mercury Education and Reduction Model legislation includes notification, product phase-outs and exemptions, product labeling, disposal bans and collection and recycling programs for mercury-added products. For more information, see www.newmoa.org/Newmoa/htdocs/prevention/mercury/.

4.3 Northwest Product Stewardship Council

The Northwest Product Stewardship Council (NWPSC), a group of government agencies and non-profit organizations working with businesses to integrate product stewardship into the policy and economic structures of the Pacific Northwest, developed *A Guide to Environmentally Preferable Computer Purchasing.* The Guide offers suggestions to buyers of computer equipment to assist them in incorporating product stewardship principles in purchasing criteria and bids. To complement this effort, NWPSC is also working with major computer purchasers in the Northwest to encourage greener electronics purchasing. The guide can be downloaded at www.govlink.org/nwpsc/Computer.htm.

4.4 Western Electronic Product Stewardship Initiative

Similar to the Northeast Recycling Council, the Western Electronic Product Stewardship Initiative (WESPI) is designing and testing the acceptability of a shared responsibility framework for the life cycle management of electronic equipment. WESPI is sponsored by the Northwest Product Stewardship Council and managed by Recycling Advocates, a citizen-based, non-profit organization. Financial support for this effort comes from federal (U.S. EPA), state and local agencies. The project will produce a Community Product Stewardship Workbook that articulates product stewardship goals for electronic products and provides model implementation policies, community action plans and ordinances to meet the goals. Implementation policies and action plans will be

designed through the active engagement of stakeholders, including state and local governments, the electronics industry, retailers, recyclers and non-profit organizations. The action plans will address a broad range of infrastructure needs including collection systems, equipment processing, markets, cooperative arrangements between manufacturers and public agencies and funding arrangements.

4.5 Materials for the Future Foundation

Materials for the Future Foundation is holding a series of workshops on computer procurement, recycling infrastructure development and product reuse programs. The goal of these workshops is to influence product designs and identify opportunities for manufacturers to invest in product recovery and processing infrastructures, especially in Northern California. Materials for the Future has also formed an Electronics Responsibility Initiative Taskforce (ERIT) with Silicon Valley Toxics Coalition (SVTC), the California Resources Recovery Association (CRRA), and the City of San Francisco Solid Waste and Recycling Program to explore EPR initiatives for electronics (see www.materials4future.org/).

4.6 Southern Waste Information eXchange

The Southern Waste Information eXchange (SWIX), a non-profit clearinghouse and repository for information on recycled products and waste regulations in the southeastern U.S., recently launched a web site (www.ElectronicXchange.org) on electronic equipment recycling in conjunction with Waste Management. The web site allows users to post notices on equipment that is "available" or "wanted" for reuse and recycling. It also serves as vehicle for the dissemination of information on regulatory developments in the Southeast, publications on electronics recycling, and links to other available resources and organizations.

SWIX has also sponsored several workshops on EOL electronics in the past few years. These workshops, held in conjunction with state and regional government agencies, were designed to educate interested organizations, businesses, and government agencies on policy developments, approaches and issues in electronics collection and recycling.

5 State Initiatives

Several U.S. states are aggressively pursuing policies and programs targeting the electronics waste stream. These leading states are shaping the future of electronics recycling policy and infrastructure development in the United States, and creating a heightened awareness of the electronics waste stream. As a result, an increasing number of other states and local organizations, charities and companies, are stepping forward to develop electronics collection and recycling programs. State concerns center around several issues, including the growth of the electronics waste stream, its potential toxicity and the recovery of valuable resources.

For example, **Massachusetts** developed a five-point strategy to divert CRTs from landfills and incinerators and increase reuse and recycling by making it more accessible and reducing costs. The strategy includes:

- Hazardous waste exemption for intact CRTs, requiring no special manifests or handling requirements for these "commodities", until they are thrown out or physically processed (e.g., crushed);
- Ban on the disposal of CRTs in incinerators or landfills beginning April 2000;
- Establish a state-wide contract that guarantees a market and maximum rate for electronics recycling services;
- Research and develop TV and monitor repair and recycling markets; and
- Establish municipal grant program that covers electronic processing costs and establishes permanent, regional collection facilities that include not-for-profit reuse organizations (see www.state.ma.us/dep/recycle/crt/crthome.htm).

A summary of the background research supporting the development of Massachusetts' recycling strategy is available at www.epa.gov/region01/compliance/solid/jtrfinal00.pdf.

The **Minnesota** Office of Environmental Assistance (MOEA) developed a state product stewardship policy that is being implementing through voluntary partnerships with businesses and government agencies. An electronics task force focusing on CRTs will make recommendations for recovery and recycling goals in the state, identify alternative (non-governmental) financing mechanisms, and obtain commitments for managing EOL electronics from manufacturers, sellers, and product users. The State also teamed up with Sony Electronics, Waste Management Inc., the American Plastics Council and Panasonic/Matsushita Electric to test the economic viability of various collection and processing strategies for waste electronics. Based on this success, Sony signed a five-year agreement with Waste Management and MOEA to establish an ongoing program to recover and recycle Sony products free of charge in Minnesota.

The **Florida** Department of Environmental Protection has developed a strategy similar to the State of Massachusetts for managing CRTs and other end-of-life electronic equipment. The four-pronged strategy aims to clarify the regulatory framework for handling CRTs, promote the development of the recycling infrastructure through grants, pursue pilot programs to evaluate various management options and execute a state recycling contract for use by Florida governmental agencies. The State is also considering a future ban on disposal of CRTs. Any ban would be phased in as the recycling infrastructure for CRTs is developed. Florida's efforts target CRTs in televisions and computer monitors due to the potential lead content. The DEP believes that, if televisions and computer monitors are recycled or reused in quantity, then other electronics will be drawn into the recycling system (see www.dep.state.fl.us/dwm/programs/electronics/).

6 Not-for-Profit Organizations

6.1 National Recycling Coalition

The National Recycling Coalition established its Electronics Recycling Initiative to promote the environmentally and economically responsible management of electronic products. The project is supported by the U.S. Environmental Protection Agency and the U.S. Postal Service. The Initiative provides several services, principally through its web site (www.nrc-recycle.org/programs/electronics/), including:

- Online discussions about issues and approaches to electronics collection and recycling through its Electronics Recycling Online Forum;
- Profiles of state and local policy initiatives as well as updates on international policy initiatives; and
- Sample requests for proposals (RFP) documents for consumer/municipal electronic equipment collection programs.

6.2 National Safety Council's EPR2 Roundtable

The Electronics Product Recovery and Recycling (EPR2) Conference is an outgrowth of EPA's Common Sense Initiative project on computers and electronics. The first EPR2^{tm} Conference, managed by the National Safety Council's Environmental Health Center, was held in 1997 to provide a forum for exchanging information and developing innovative strategies for managing end-of-life electronic equipment. In April 2001, the EPR2 Conference will convene jointly with the Electronics Recycling Summit, a forum designed to build partnerships and common action plans among industry, government and non-profits to increase electronics recycling and reuse.

With funding from the EPA and private donations, the National Safety Council has undertaken several additional initiatives for EOL electronics, including:

- A report, *Electronic Product Recovery and Recycling Baseline Report: Recycling of Selected Electronic Products in the United States*, that presents the results of the first large-scale survey of end-of-life electronic product recycling and reuse in the United States (www.nsc.org/ehc/epr2/baseline.htm); and
- An on-line database of electronics recyclers by state (available at www.nsc.org/ehc/epr2/recycler.htm).

6.3 Clean Computer Campaign

The Silicon Valley Toxics Coalition (SVTC) launched its Clean Computer Campaign in 1997 to reduce the life cycle impacts of computers and to promote environmentally sustainable development, extended producer responsibility and corporate and government accountability. The Clean Computer Campaign produces an annual "Report Card" on the environmental performance of computer manufacturers in the U.S.,

Europe and Asia; and released a report documenting the hazardous materials contained in computers and the resulting EOL wastes. For more information see www.svtc.org/cleancc/index.html.

7 Industry Organizations

7.1 International Association of Electronics Recyclers

The International Association of Electronics Recyclers (IAER) is a not-for-profit trade association formed in 1998 to represent and serve the interests of the emerging electronics recycling industry. A major goal of the IAER is to promote high standards of environmental quality and regulatory compliance in the industry. To this end, in 2000 IAER established a formal process to certify electronics recyclers. The certification program focuses on management systems, not the evaluation of operational and technical processes and performance. IAER also developed and maintains an online database of electronics recycling organizations and publishes a monthly newsletter, also available online, that provides updates on developments affecting the industry (see www.iaer.org).

7.2 Institute of Electrical and Electronics Engineers

The premier technical conference on electronics and the environment is sponsored by the International Electrical and Electronic Engineers (IEEE), an association representing professionals in the industry. In 2001, the IEEE will convene its 9th conference, the International Symposium on Electronics and the Environment. This annual conference, attended by leaders from industry and academia, features the latest developments in product design, environmental management practices, research and recycling practices.

7.3 Electronic Industries Alliance

In February 2001, the Electronic Industries Alliance (EIA), the major trade association representing the electronics and high tech industries in the U.S., launched its new Consumer Education Initiative (CEI), an effort designed to encourage consumers to reuse and recycle used electronics such as TVs, PCs, VCRs and cell phones. The Consumer Education Initiative, includes a web site (www.eiae.org), that directs consumers to organizations that collect used electronics for recycling or reuse, including municipal collection programs, local charities, private companies and other local and national recycling programs. The web site is searchable by state as well as by national programs. To publicize the CEI, participating manufacturers have committed to incorporate an industry statement in product owner manuals, company web sites, or product packaging and literature, directing consumers to the web page. When the web site was officially launched over 20 original equipment manufacturers had signed onto the program, including IBM, Dell, Hewlett Packard, Apple, Xerox, Canon, Motorola, Panasonic, Sony and Sharp.

The Consumer Education Initiative was a product of EIA's Environmental Issues Council (EIC), a forum for EIA members to examine, influence and coordinate industry-wide action on environmental issues (see www.eia.org/government/eic/index.cfm). In addition to addressing regulatory and legislative issues, the EIC creates collaborative industry projects focusing on environmental issues. The EIC, for example, partners with the U.S. EPA on its DfE Computer Display Project and Energy Star programs and participated on Minnesota's CRT Task Force and pilot collection project.

7.4 American Plastics Council

One of the greatest challenges in electronics recycling is the cost-effective recovery and reutilization of plastics. For over 10 years, the American Plastics Council, the major trade association for the U.S. plastics industry, has worked to advance the state-of-the-art and improve the economics of recycling plastics from durable goods such as automobiles, appliances and electronics. Much of their work has focused on the development of mechanical processes for rapid identification, size reduction and separation of plastics to achieve clean high-value output. Most recently APC partnered with the Minnesota Office of Environmental Assistance, Sony Electronics, and Waste Management to collect and analyze plastics from the residential electronics waste stream. For more information, see www.plasticsresource.com/recycling/index.html.

7.5 IPC

IPC, the national trade association for the printed circuit board and assembly industries, is actively engaged in collaborative projects aimed at reducing the environmental impact of electronic products. The organization partners with EPA in its DfE Printed Wire Board project. Most recently, IPC has taken the U.S. lead in the development of a lead-free roadmap in response to international regulatory and market pressures to eliminate lead solder in printed circuit boards. The roadmap compiles a wealth of information on lead-free electronics, including national and international policy developments, the activities of industry organizations and leading manufacturers, alternative technologies and challenges to the transition to lead-free technologies (see www.leadfree.org/).

8 Influential International Developments

8.1 Electronics Recycling Legislation

Legal mandates for the recovery and recycling of electronic equipment, often referred to as "product take-back" legislation, are proliferating in the international arena. These electronic recycling ordinances, in general, create new "cradle to grave" responsibility for products put on the market. The ordinances obligate manufacturers and importers of products to take responsibility for equipment at the end-of-life, and to ensure that the equipment is recycled or disposed of properly. The legislation establishes

fundamental requirements -- a framework -- in which manufacturers must develop specific implementation plans for achieving the objectives of the legislation.

In 1991, Germany issued the first electronics recycling ordinance, which proposed manufacturer responsibility for the recovery and recycling of electronic equipment at the end of life. Since then, many European and Scandinavian countries, as well as Japan, Taiwan, and the European Union have introduced similar legislation.

The ultimate goals of the waste ordinances are to prevent waste and increase recycling. The mechanism to achieve these goals is to shift responsibility for the cost of recycling and waste disposal to the "polluter" through the assignment of responsibility to the producer. Producer responsibility is intended to internalize the costs of waste disposal in the price of new products, while stimulating design changes to improve the efficacy of future recycling efforts.

There has been much discussion between government authorities and industry since Germany introduced the first draft electronics ordinance in 1991. The debates have centered around several key issues, including financing, distribution of responsibility among manufacturers, retailers and local authorities, product sector differentiation, and "historical" waste (i.e., equipment put on the market before the ordinance is in effect).

Most government authorities are applying the principles of manufacturer responsibility to the electronics waste stream, as described above, with the notable exception of Denmark. Denmark will require municipalities to run collection and recovery schemes for electronic equipment, paid for through local taxes.

8.2 WEEE Directive

In June 2000, the European Commission adopted a proposal for a Directive on Waste Electrical and Electronic Equipment (WEEE) and a proposal for a Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment. The WEEE Directive aims to limit the total quantity of waste going to final disposal by increasing reuse and recycling. Producers will be responsible for the taking back equipment, providing incentives to take waste management into account when designing products.

The WEEE Directive, which covers a broad range of electrical and electronic products, calls for:

- Government to establish collection points for equipment from private households.
- Producers to take over the responsibility and financial obligation for equipment at designated collection points and channel it to certified processing facilities.
- Customers to return equipment free of charge.
- Minimum recovery requirements (ranging from 60 to 80% by weight) and reuse and recycling requirements (50 to 70% by weight) by 2006 depending on the product category.

The proposed EU Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment requires the elimination of lead, mercury, cadmium and hexavalent chromium in electronic equipment by 2008 in order to prevent the generation of hazardous waste. In addition, manufacturers must find substitutes for two types of brominated flame retardants, PBB and PBDE, without lowering the fire safety standards. The Directive provides for an exemption from the requirement if substitution is not possible.

8.3 Japanese Law for Recycling of Specified Consumer Electronic Goods

The Japanese law for household appliance recycling, enacted in 1998 and fully enforceable as of 2001, requires industry to establish a recovery and recycling system for used products. The law allows for financing through end-user fees and the collection of used products by municipalities and retailers. The law currently covers televisions, air conditioners, refrigerators, and washing machines, but plans are underway to extend the recycling provisions to electronic products such as personal computers and copiers.

8.4 OECD Guidelines on the Management of Used and Scrap Computers

The U.S. EPA is taking the lead in developing international guidelines on the "environmentally sound management" (ESM) of used and scrap personal computers for the Organization for Economic Cooperation and Development (OECD). OECD plans to develop ESM guidelines for different recyclable wastes, with personal computers serving as the pilot case. Initially, the principal focus of the OECD ESM program is on waste recovery and recycling, rather than upstream (e.g., product design) and downstream (e.g., disposal) issues. An important goal of the ESM program is to develop guidelines for both domestic and transboundary waste recovery that will help "level the playing field" in OECD member countries, and to assist OECD member countries in making determinations of environmentally sound management for waste exports.